

CLAIMS

We claim:

1. A method for automatically controlling the quality of cigarettes produced in a manufacturing process which comprises the steps of:

- a. automatically sampling and testing at least one component part to be used in manufacturing completed cigarettes to measure the value of at least one quality parameter of said at least one component part;
- b. automatically sampling and testing completed cigarettes to measure the value of at least one quality parameter of said completed cigarettes, wherein the quality parameter of said completed cigarettes has a desired relationship to the quality parameter of said component part;
- c. communicating the measured values of the quality parameters measured for said component part and said completed cigarettes to a computer;
- d. evaluating said measured values of the quality parameter measured for said component part and said completed cigarettes by said computer in relation to stored data enabling said computer to:
 - (i) determine, according to a first pre-establish algorithm, whether an adjustment of the operational controls of at least one machine in the manufacturing process is required so that the relationship between the measured value of the quality parameter of said component part and the measured value of the quality parameter of said completed cigarettes will be optimal and if so, to determine, according to said first pre-established algorithm, the degree to

1 which an adjustment of the operational controls of said at least one machine in
2 the manufacturing process should be adjusted, and;

3 (ii) send an electronic signal by said computer to said at least one machine in the
4 manufacturing process to make said adjustment in such degree as was
5 determined by said computer;

6 e. adjusting said one machine in the manufacturing process in accordance with said
7 electronic signal sent by said computer.

8 2. The method of claim 1 wherein said automatic testing and sampling of a component part
9 is done at regular intervals during said manufacturing process and wherein said automatic
10 testing and sampling of completed cigarettes is done at regular intervals during said
11 manufacturing process.

12 3. The method of claim 1 wherein said automatic testing and sampling of a component part
13 is done at intervals of less than five minutes during said manufacturing process and
14 wherein said automatic testing and sampling of completed cigarettes is done at intervals
15 of less than five minutes during said manufacturing process.

16 4. The method of claim 3 wherein said completed cigarettes automatically tested and
17 sampled are completed cigarettes which are manufactured from the component parts
18 drawn from the same sub-population as the sub-population of component parts which
19 have been automatically tested and sampled.

20 5. The method of claim 1 wherein the step of automatically sampling and testing at least one
21 component part includes automatically sampling and testing filter sections.

22 6. The method of claim 5 wherein the step of automatically sampling and testing completed
23 cigarettes to measure the value of at least one quality parameter includes measuring the

1 circumference of the tobacco component of said completed cigarettes, and wherein the
2 step of automatically sampling and testing filter sections includes measuring the
3 circumference of said filter sections.

4 7. The method of claim 5 wherein the step of automatically sampling and testing filter
5 sections further includes measuring the pressure drop across said filter sections and where
6 the step of automatically sampling and testing completed cigarettes further includes
7 measuring the ventilation of said completed cigarettes.

8 8. The method of claim 5 wherein the step of automatically sampling and testing at least one
9 component part further includes automatically sampling and testing tobacco rod
10 segments.

11 9. The method of claim 8 wherein the step of automatically sampling and testing completed
12 at least one quality parameter of at least one component part includes measuring the
13 density of tobacco rod segments.

14 10. The method of claim 9 wherein the step of automatically sampling and testing filter
15 sections further includes measuring the weight of said filter sections and wherein the step
16 of automatically sampling and testing completed cigarettes further includes measuring the
17 weight of said completed cigarettes.

18 11. The method of claim 8 wherein the step of automatically sampling and testing at least one
19 quality component of at least one component part includes measuring the weight of
20 tobacco rod segments.

21 12. The method of claim 11 wherein the step of automatically sampling and testing filter
22 sections further includes measuring the weight of said filter sections and wherein the step

1 of automatically sampling and testing completed cigarettes further includes measuring the
2 weight of said completed cigarettes.

3 13. The method of claim 1 further comprising the steps of

4 a. measuring during the production process by an in-line measuring device, the
5 value of at least one quality parameter of at least one component part which
6 quality parameter of said component part has a known relationship to at least one
7 quality parameter measured by said automatic testing and sampling of said
8 completed cigarettes;

9 b. communicating said measured value of at least one quality parameter of said
10 component part measured by said in-line measuring device to said computer;

11 c. evaluating said measured value of said quality parameter of said component part
12 by said in-line measuring device in relation to the values of a least one quality
13 parameter measured by said automatic testing and sampling of said completed
14 cigarettes by said computer to determine whether said measured value of at least
15 one quality parameter of said component part measured by said in-line measuring
16 device is accurate and if not, enabling said computer to:

17 (i) determine, according to a second pre-establish algorithm,
18 whether a recalibration of said in-line measuring device is
19 required and if so, to determine, according to said second pre-
20 established algorithm, the degree to which such recalibration is
21 required, and;

22 (ii) send an electronic signal by said computer to said at least one
23 machine in the manufacturing process to recalibrate such in-line

1 measuring device in such degree as was determined by said

2 computer;

3 d. recalibrating said in-line measuring device in accordance with said electronic

4 signal from said computer.

5 14. The method of claim 13 wherein said component parts include tobacco rod segments and
6 filter sections.

7 15. The method of claim 14 wherein the quality parameter measured by said in-line
8 measuring device includes the density of said tobacco rod segments and wherein the
9 quality parameters of completed cigarettes measured by said automatic testing and
10 sampling of said completed cigarettes includes the weight of said completed cigarettes
11 and wherein the quality parameters of filter sections measured by said automatic testing
12 and sampling of said filter sections includes the weight of said filter sections.

13 16. The method of claim 14 wherein the quality parameter measured by said in-line
14 measuring device includes the weight of said tobacco rod segments and wherein the
15 quality parameters of completed cigarettes measured by said automatic testing and
16 sampling of said completed cigarettes includes the weight of said completed cigarettes
17 and wherein the quality parameters of filter sections measured by said automatic testing
18 and sampling of said filter sections includes the weight of said filter sections.

19 17. The method of claim 14 wherein the quality parameter of a said component part
20 measured by said in-line measuring device includes the circumference of said tobacco rod
21 segments and wherein the quality parameters of completed cigarettes measured by said
22 automatic testing and sampling of said completed cigarettes includes the circumference
23 of the tobacco component of said completed cigarettes.

1 18. A method for automatically controlling the quality of cigarettes produced in a
2 manufacturing process which comprises the steps of:

3 f. automatically sampling and testing at least one component part to be used in
4 manufacturing completed cigarettes to measure the value of at least one quality
5 parameter of said at least one component part;

6 g. automatically sampling and testing completed cigarettes to measure the value of at
7 least one quality parameter of said completed cigarettes, wherein the quality
8 parameter of said completed cigarettes has a desired relationship to the quality
9 parameter of said component part;

10 h. communicating the measured values of the quality parameters measured for said
11 component part and said completed cigarettes to a computer;

12 i. evaluating said measured values of the quality parameter measured for said
13 component part and said completed cigarettes by said computer in relation to stored
14 data enabling said computer to:

15 (i) determine, according to a first pre-establish algorithm, whether an adjustment
16 of the operational controls of at least one machine in the manufacturing
17 process is required so that the relationship between the measured value of the
18 quality parameter of said component part and the measured value of the
19 quality parameter of said completed cigarettes will be optimal and if so, to
20 determine, according to said first pre-established algorithm, the degree to
21 which an adjustment of the operational controls of said at least one machine in
22 the manufacturing process should be adjusted;

1 (ii) generate a set of video displays to indicate the adjustment which should be
2 made in the operational controls of said at least one machine in the
3 manufacturing process, and;

4 (iii) communicate said set of video displays to a video display terminal;
5 j. displaying on a video display terminal said set of video displays indicating the
6 adjustment which should be made in the operational controls of said at least one
7 machine in the manufacturing process.

8 19. The method of claim 18 wherein said automatic testing and sampling of a component part
9 is done at regular intervals during said manufacturing process and wherein said automatic
10 testing and sampling of completed cigarettes is done at regular intervals during said
11 manufacturing process.

12 20. The method of claim 18 wherein said automatic testing and sampling of a component part
13 is done at intervals of less than five minutes during said manufacturing process and
14 wherein said automatic testing and sampling of completed cigarettes is done at intervals
15 of less than five minutes during said manufacturing process.

16 21. The method of claim 20 wherein said completed cigarettes automatically tested and
17 sampled are completed cigarettes which are manufactured from the component parts
18 drawn from the same sub-population as the sub-population of component parts which
19 have been automatically tested and sampled.

20 22. The method of claim 18 wherein the step of automatically sampling and testing at least
21 one component part includes automatically sampling and testing filter sections.

22 23. The method of claim 22 wherein the step of automatically sampling and testing
23 completed cigarettes to measure the value of at least one quality parameter includes

1 measuring the circumference of the tobacco component of said completed cigarettes, and
2 wherein the step of automatically sampling and testing filter sections includes measuring
3 the circumference of said filter sections.

4 24. The method of claim 22 wherein the step of automatically sampling and testing filter
5 sections further includes measuring the pressure drop across said filter sections and where
6 the step of automatically sampling and testing completed cigarettes further includes
7 measuring the ventilation of said completed cigarettes.

8 25. The method of claim 22 wherein the step of automatically sampling and testing at least
9 one component part further includes automatically sampling and testing tobacco rod
10 segments.

11 26. The method of claim 25 wherein the step of automatically sampling and testing at least
12 one quality component of at least one component part includes measuring the density of
13 tobacco rod segments.

14 27. The method of claim 26 wherein the step of automatically sampling and testing filter
15 sections further includes measuring the weight of said filter sections and wherein the step
16 of automatically sampling and testing completed cigarettes further includes measuring the
17 weight of said completed cigarettes.

18 28. The method of claim 25 wherein the step of automatically sampling and testing at least
19 one quality parameter of at least one component part includes measuring the weight of
20 tobacco rod segments.

21 29. The method of claim 28 wherein the step of automatically sampling and testing filter
22 sections further includes measuring the weight of said filter sections and wherein the step

1 of automatically sampling and testing completed cigarettes further includes measuring the
2 weight of said completed cigarettes.

3 30. The method of claim 27 further comprising the steps of

4 a. measuring during the production process by an in-line measuring device, the
5 value of at least one quality parameter of at least one component part which
6 quality parameter of said component part has a known relationship to at least one
7 quality parameter measured by said automatic testing and sampling of said
8 completed cigarettes;

9 b. communicating said measured value of at least one quality parameter of said
10 component part measured by said in-line measuring device to said computer;

11 c. evaluating said measured value of at said quality parameter of said component
12 part by said in-line measuring device in relation to the values of a least one
13 quality parameter measured by said automatic testing and sampling of said
14 completed cigarettes by said computer to determine whether said measured value
15 of at least one quality parameter of said component part measured by said in-line
16 measuring device is accurate and if not, enabling said computer to:

17 (i) determine, according to a second pre-establish algorithm,
18 whether a recalibration of said in-line measuring device is
19 required and if so, to determine, according to said second pre-
20 established algorithm, the degree to which such recalibration is
21 required, and;

22 (ii) send an electronic signal by said computer to said at least one
23 machine in the manufacturing process to recalibrate such in-line

1 measuring device in such degree as was determined by said
2 computer;

3 d. recalibrating said in-line measuring device in accordance with said electronic
4 signal from said computer.

5 31. The method of claim 30 wherein said component parts include tobacco rod segments and
6 filter sections.

7 32. The method of claim 31 wherein the quality parameter measured by said in-line
8 measuring device includes the density of said tobacco rod segments and wherein the
9 quality parameters of completed cigarettes measured by said automatic testing and
10 sampling of said completed cigarettes includes the weight of said completed cigarettes
11 and wherein the quality parameters of filter sections measured by said automatic testing
12 and sampling of said filter sections includes the weight of said filter sections.

13 33. The method of claim 31 wherein the quality parameter measured by said in-line
14 measuring device includes the weight of said tobacco rod segments and wherein the
15 quality parameters of completed cigarettes measured by said automatic testing and
16 sampling of said completed cigarettes includes the weight of said completed cigarettes
17 and wherein the quality parameters of filter sections measured by said automatic testing
18 and sampling of said filter sections includes the weight of said filter sections.

19 34. The method of claim 31 wherein the quality parameter of a said component part
20 measured by said in-line measuring device includes the circumference of said tobacco rod
21 segments and wherein the quality parameters of completed cigarettes measured by said
22 automatic testing and sampling of said completed cigarettes includes the circumference
23 of the tobacco component of said completed cigarettes.